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ABSTRACT

A case study documented the emergence of literacy in an extremely precocious reader between the ages of 2 years, 7 months and 3 years, 2 months. The case study examined the relation between the subject's oral language and reading development; the bases of his word identification; the relation between his reading and writing development; and whether the early development of a precocious reader's language skills shows exceptional strengths in areas found to be deficient in pre-dyslexic children. Data included observations made in the home, standardized test data gathered during the study period, and reports from the subject's mother (who had graduate training in the teaching of reading and encouraged the subject's reading) both before and after the study. Results indicated that: (1) while the subject performed poorly on phonological awareness and other metalinguistic items, his reading and spontaneous language use suggested achievement in at least some kinds of awareness of sounds and patterns within words; (2) the syntactic complexity of the subject's language, his mother's reports, and his ability to integrate both correct and scrambled letter strings were all consistent with the conclusion that the precocious development of phonologically based word identification skill is associated with superior working memory; and (3) the subject's information performance was consistent with group data suggesting only a modest relationship between reading precocity and semantic development. Findings suggest the importance of looking for target skills, not just supposed prerequisites, in evaluating precocious readers. (One figure and one table of data are included; 22 references are attached.) (RS)

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Early Development of Language and Literacy Skills of an Extremely Precocious Reader

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Abstract

This case study documents the emergence of literacy in an extremely precocious reader between the ages of 2 years, 7 months and 3 years, 2 months. At the end of this period, the child's word recognition ability was conservatively estimated at the late first grade level, and he was able to use knowledge of some level of letter-sound correspondences to sound out unfamiliar words and pseudowords. However, his development was uneven. The results are used to generate hypotheses about the nature and measurement of precocious reading skills in very young children and relationships between precocious reading and the development of oral language and writing skills.

Early Development of Language and Literacy Skills of an Extremely Precocious Reader

Precocious readers learn to read at unusually early ages, without formal instruction and with varying degrees of adult assistance (Jackson, 1988). Because precocious readers learn to read without the imposed structure of formal schooling, they can be an important source of information about how reading skills are acquired. However, few studies have explored how precocious readers learn to read. No effective and efficient system for identifying potential precocious readers has been designed, so most such children have been studied only after they have acquired rudimentary reading skills, usually at age 4 or later (e.g., Jackson, Donaldson, & Cleland, 1988; Tobin & Pikulski, 1989). Case histories of early literacy development have focused on children whose rate of progress in reading has been average or only moderately advanced (e.g., Baghban, 1984). Answers to questions about the early development of precocious readers' skills have been limited by the information available in retrospective parent anecdotal reports or baby book records.

Lack of information about the emergence of precocious reading hinders efforts to develop theoretical models that can account for the full range of individual differences in reading acquisition. For example, it may be useful to know whether

component reading skills and related abilities that develop very poorly in dyslexic children develop especially well in precocious readers.

The present case study of a very young child still in the beginning stages of learning to read provided an opportunity to address several questions about the emergence of precocious reading. "Max," a precocious reader, was observed and tested repeatedly across a period of eight months beginning when he was 2 years and 7 months old. The case study addressed five issues: the adequacy of standardized tests designed for older children for assessing the skills of a very young reader, the relation between oral language and reading development, the bases of word identification, the relation between reading and writing development, and whether the early development of a precocious reader's language skills shows exceptional strengths in areas found to be deficient in pre-dyslexic children.

Max's mother contacted the investigator's department when he was about 2 years, 5 months of age. She reported that her son had read the word "pizza" out of context at his second birthday and, in the following two months, had learned to read three new words a day. The investigators observed Max's reading and language development on thirteen occasions when he was between the ages of 2 years, 7 months and 3 years, 2 months. Most data

collection sessions were conducted in Max's home with his mother present. Both concurrent and retrospective reports of his oral language and reading were collected from Max's mother, who had graduate training in the teaching of reading.

Three types of data were collected on Max's reading development: the historical data reported by Max's mother of language and reading development before age 2:7; the observations and standard test data collected during the study period (age 2;7 to 3;2), and his mother's reports of Max's language and literacy development subsequent to the study (age 3;2 to 3;11). Highlights of Max's reading development and the schedule of our observations and tests are indicated in Figure 1.

Insert Figure 1 about here

Reading History

Max's mother had kept a record of Max's early oral language and reading development, including phonetic spellings of his first vocables (wordlike utterances) and what they represented, the first letters he learned, and the first words he learned to read. At age 1;8 Max brought five blocks to his mother and accurately named the letters on each block. Because his parents had not taught him the names of the letters, they speculated that

Max had learned the letters from watching the television show, "Wheel of Fortune." Prior to this incident, Max's language development had not seemed remarkable to his parents. His oral language may even have been somewhat behind that of his age mates. During the month after Max named his first letters (age 1;8 to 1;9) he learned half of the alphabet, and his oral language skills also started to expand rapidly. Max learned to recognize written words from signs, television, and his mother reading to him. He also started noticing shapes in the environment which resembled letters, such as a "w" shape on a balcony near his home. After Max read the word "pizza" out of context, his mother started using metallic letters on the refrigerator to teach Max three words each day that were related to the day's activities. Some of the first words he learned by this method were "hospital," "horses," "scared," "rained," and "tissue."

When Max reached age 2;1, his mother began a composition book. For several days, she composed stories using words that Max knew how to read. However, it was difficult to write about the day's activities with a limited number of words. After four days, she started writing stories in her own language, including words that were unfamiliar to Max. For example, the entry for the day Max was age 2;3 was

WHEN WE PASS THE FIRE STATION ON THE WAY TO PLAYGROUP MAX ALWAYS SAYS, WITH VIGOR, "TWO FIRE ENGINES. I CAN'T STAND IT." HE'S A FUNNY FELLA. HE CHECKED MY EARS FOR CHEERIOS YESTERDAY.

DADDY BOUGHT A BASKETBALL AND TEA SET FOR MAX. GRANDMA SENT AN INFLATABLE CRUISE SHIP FROM HER VACATION.

MAX SAT WITH ERICA IN THE HIGH CHAIRS AT PLAYGROUP AND MADE BABY NOISES.

His mother and Max read all the composition book entries each day until the number grew too cumbersome. Max memorized many of the earlier entries, and his mother felt that he learned many new words through this activity.

Max's mother supposed that he began reading books by memorizing sentences using one or two recognized words to cue himself. If he did not recognize a word out of context he would respond "I don't know." At age 2;7, he began sounding out unfamiliar words, and by age 2;9 Max made attempts to sound out most unfamiliar words. The names of the four Hebrew letters used in the game dreidel were presented to Max once at age 2;9, and he was then able to identify them correctly.

Max began watching "Sesame Street" at age 1;6, but his interest in the program was sporadic. Videos, especially of the

children's performer, Raffi, were often Max's viewing preference. In addition to singing and dancing with the video, he also memorized songs from the Raffi video, which he enjoyed performing. Max was interested in telling jokes, which often involved repeatedly relating parts of videos that his dad had thought were funny.

Max's mother reported that she routinely read him a story before nap and before bedtime each day. Observations supported her report that she used an interactive style while reading a story, asking Max questions about the story and having him anticipate what would happen next.

Max's mother encouraged Max's reading development, primarily by keeping a journal of their daily activities and reading it with him. She felt that Max's interest and motivation to learn to decode words was primarily self-generated. She provided reading materials such as metallic letters on the refrigerator, and answered his questions about words, but reported that she was careful not to push him to learn to read. In fact, as is characteristic of many precocious readers (Jackson, 1988), at times Max seemed obsessed with learning to decode or with whatever reading task he currently found fascinating.

Standard Tests and Observations of Reading and Oral Language Development

The study measures included several standard tests of language development and academic achievement: the MacArthur Communicative Development Inventory: Toddlers (CDI: Toddlers; Fenson et al., 1991) at age 2;7; the Peabody Individual Achievement Test-Revised (PIAT; Markwardt, 1989) at ages 2;7 and 3;2; Concepts About Print (Clay, 1979) and the Test of Early Reading Ability (TERA; Reid et al., 1981) at age 2;10; the Test for Auditory Comprehension of Language-Revised (TACL-R, Carrow-Woolfolk, 1984) at age 3;0; and the WPPSI-R information subtest at age 3;2 (Wechsler, 1989). We also recorded and analyzed Max's productive language, computing mean length of utterance (MLU) at ages 2;7 and 2;8, and audio-tape recorded his reading of both familiar and unfamiliar texts on a number of occasions.

Standard Tests of Reading

We administered the PIAT-R to Max because the original version of the PIAT had been found to be a reliable and potentially valid measure of individual differences in reading precocity among intellectually gifted 3 and 4 year olds (Shorr, Jackson, & Robinson, 1980). However, two attempts to administer the reading sections of the PIAT-R to Max suggested that

extensive revision of pre-reading items in the Reading Recognition subtest may have made the 1989 test less appropriate for very young readers. Max was able to complete some pre-reading items involving letter and word matching, but he failed items requiring finding embedded words and matching words on initial sounds. Directions for some items had to be rephrased before he could comprehend them. For example, he did not understand the direction "Find one like this--down here. Point to it." in the matching section. When the question was rephrased to "Find the [letter name] and now find the other [letter name] he was able to do the letter matching task.

Because she knew that Max could read words, the examiner administered word-reading items even though this violated standard administration procedures for the test. Max read 7 words correctly at age 2;7 and 15 words at age 3;2, yielding the estimated age- and grade-equivalent scores reported in Table 1.

Max's PIAT-R scores were consistent with his performance on the other two reading tests administered at age 2;10 (TERA age-equivalent score 5;2 and Concepts About Print score in age range 6;0-6;6). As on the PIAT-R, Max consistently failed the advanced print concept items on the Concepts About Print.

At a minimum, Max seems to have been reading about as well as the average child twice his age. However, Max was easily

distracted and often uncooperative in test sessions. If the testing task did not interest him or if he was inspired by the test to start playing with words, it was impossible to get an accurate picture of his ability level. Therefore, all these estimates seem conservative relative to the word identification skills Max demonstrated informally for his mother and the examiner. For example, he was observed reading the word "cholesterol" and sounding out unfamiliar proper names correctly (age 3;1).

Prior research has shown that reading precocity and verbal intelligence are related (Jackson, 1988), but linguistic precocity is neither necessary (Healy, 1982) nor sufficient (Crain-Thoreson & Dale, 1991) for precocity in reading. The question of whether certain aspects of oral language development are more closely associated than others with reading precocity remains open, and the results of our assessments of Max's oral language production and comprehension suggest the complexity of this issue. Max's reading was exceptionally advanced, but his oral language ranged from about average to extremely advanced depending on the measure used.

Max was just beyond the 30-month upper age limit for the MacArthur Communicative Development Inventory: Toddlers (CDI) when his mother completed this report of his productive language

during the period when he was 30-31 months old. The inventory asks parents to identify whether words are part of their child's vocabulary and to give examples of the child's sentences.

Overall, Max's CDI performance was good but not extraordinary. His scores for total vocabulary and sentence grammatical complexity were both above the 90th percentile. In use of irregular noun and verb forms Max scored between the 75th and 90th percentiles. His "three longest sentences," which had a mean length of utterance (MLU) of 12 morphemes, earned Max another score between the 75th and 90th percentiles. The longest of these sentences was "I want to leave the garlic there because haveta don't get paint on it."

Analysis of two oral language samples was consistent with a judgment that at least some aspects of Max's oral language were advanced. His MLU was computed by two independent raters using standard guidelines from speech samples collected by the first author (Dale, 1976). Max's MLU's computed from the more conservative rater's scoring at ages 2;7 and 2;8 were 7.25 and 8.86 morphemes per utterance, respectively. These MLU values are lower than the estimate from the MacArthur CDI: Toddlers because they reflect typical speech rather than "best" examples. In these samples of conversation, Max's sentences were complex, with unusually advanced mastery of auxiliary verbs and conjunctions.

However, the vocabulary used in these speech samples was characterized by one of the authors of the MacArthur CDI: Toddlers as "good, but not remarkable" (Dale, personal communication, July, 1990).

Despite Max's generally strong performance on parent report and direct observation measures some aspects of his productive language were advanced, his performance on tests of verbal knowledge and language comprehension was only modestly above average for his age. His WPPSI-R Information score was one SD above the mean, and his TACL-R overall age-equivalent score was in the 39-41 month range when he was tested at 36.5 months. However, when asked, as part of the WPPSI, what a common food was made of, Max retrieved the item from his kitchen and read the ingredients on the package label.

One might reasonably expect the language development of precocious readers to be in the inverse of the development of children who will eventually be identified as dyslexic, with precocious readers showing their greatest strengths in those areas in which pre-dyslexics are weakest. Comparing Max's early language development with the results of Scarborough's (1990) longitudinal study of the language deficits of pre-dyslexic children lends support to this hypothesis. At age 2;6 the mean MLU computed for a group of 20 pre-dyslexic children was 2.35

words per utterance, and the mean MLU for the 20 normal readers included in the study was 2.89 words per utterance. At age 2;7 Max's MLU was 7.25 words per utterance and at age 2;8, 8;86. Pre-dyslexic children produced shorter sentences with simpler syntax and more pronunciation errors than other children at age 2;0; Max presented the opposite picture. He constructed unusually long and syntactically complex sentences for his age, and used accurate word pronunciation. The pre-dyslexic child's poor rhyme recitation skills contrast with Max's ability--reported by his mother and observed by the first author--to recite rhymes, songs, and long passages. We cannot be sure whether Max had strengths in phonemic awareness contrasting with the deficits shown by pre-dyslexics. Although he did not respond correctly to the phonemic awareness items on the PIAT-R, Max did start sounding out unfamiliar words at age 2;7, so his ability to identify patterns within words was well developed, although it may not have involved analysis at the level of individual letters.

Bases of Word Identification

Observations of Max's reading of unfamiliar words and pseudowords confirmed his mastery of word analysis during the period of this study. According to his mother, his word reading initially was characterized by whole-word recognition, but he

started sounding out unfamiliar words at age 2;7. Despite his advanced word identification ability, Max was relatively insensitive to letter and word order. He read "odg" as "dog," and often skipped around when reading words on a book page. The contrast between his skilled sounding out of unfamiliar words and his frequent inattention to letter order suggests that Max was able to use order information, but that he sometimes did not attend to it or could disregard it in order to make sense of a string. He may have been using a similar strategy in assembling sentence meaning from words read out of order.

Reading and Writing

Contemporary accounts of the acquisition of literacy often emphasize writing development as more observable than reading and as essential for development of the child's understanding of the meaning of both acts (Baghban, 1984; Bruner & Cole, 1990). However, precocious readers of preschool age are not always precocious writers (Jackson, 1988). Max had access to writing and drawing materials and magnetic letters, but by the age of 3;2 he had shown little interest in writing, although he could copy his name. His paintings were scribbles with no distinct forms or recognizable representations. When asked what he had drawn or painted, he would say it was a picture of a sculpture.

Max did enjoy assembling nonsense letter strings with magnetic letters and then sounding out his "words." At age 3;1 Max created the following "silly words:" iszop (pronounced "sop"), fak (pronounced "fake"), tud (pronounced "tud"), and iszopu (pronounced "zup"). Once again the order of the letters was not important. Max seemed to have been pattern finding. He constructed "iszop" then later added a "u" at the end ("iszopu") with his pronunciation changing from "sop" the "zup." Either he was pronouncing the "isz" as an "s" or "z" sound or he was ignoring some of these letters. This activity seemed more like playing with letters and reading than intentional spelling.

Continued Development

At the end of the study, Max's family moved from the town in which the investigators' university was located. Eight months later, when Max was age 3;10, Max's mother reported Max's reading, writing, and oral language progress in a letter to the first author.

Max was reading books both silently and aloud with "remarkable" dramatic expression, according to his mother. His reading was very smooth. He was able to read newspapers but often became impatient with the small print. Max enjoyed reading informational brochures, adventure picture books that were also comical, books on outer space and a range of non-fiction books,

including books of photography with informative captions, and books about animals. He enjoyed reading aloud to his younger brother.

Max's interest in maps continued. His mother reported that he could quickly put together a map puzzle of the United States, correctly placing each state. He also enjoyed finding places on the world globe and learning things about the people who live there.

Max's mother reported that his writing progress continued to be slow; and that he was critical of his writing performance. His nursery school teacher said that Max was a perfectionist who needed adult encouragement to complete art and writing projects. When copying alphabet letters, Max had difficulty copying the letters G, K, S, Z, and Y. The following letters were written upside down or backwards: L,N,P,R,U,W. He wrote the letter "F" both backwards and forwards. All of the letters Max wrote looked shaky. By age 3;10, his art had progressed to simple representation of objects. For example, a drawing he described as "Two teepees with a pipe going up" consisted of a vertical line and two inverted u shapes.

Max's mother reported that his oral language comprehension at age 3;10 was very good, a judgment she made based on the types of questions he asked after listening to adult conversation.

Max's oral language development also reflected linguistic creativity and love of playing with words. For example, Max often answered his mother's questions with quizzes. For example, if his mother asked him where he left his shoes, he would answer, "What room starts with the letter "B?" He was delighted when his mother replied, "bathroom." Max enjoyed playing word games such as "think of as many words as you can that start with the letter 'R'." He enjoyed rhyming simple words and telling jokes, but his mother reported that he often missed reciting the punch line.

When Max played with a friend whose language development was delayed, Max copied the friend's oral language, including his stutter. Max sometimes adopted this style even when his friend was not present. At other times, he seemed to be copying his teacher's "lecturing" style of speech.

Max's nursery school teacher did not treat Max differently because of his advanced reading abilities. His mother said she felt that it was important that a fuss not be made over Max and that he remain as innocent as possible about his precocity.

Conclusions

The results of this case study suggest several areas for further investigation of the development of precocious readers. On two standard tests, Max performed poorly on phonological awareness and other metalinguistic items. These items were

designed to tap skills that are closely and causally related to reading acquisition, and Max's reading and spontaneous language use suggested that he had indeed achieved at least some kinds of awareness of sounds and patterns within words. If test failures like Max's are widespread among precocious readers, further studies of this population may contribute to better ways to measure reading precocity and pre-reading skills.

The syntactic complexity of Max's productive language, his mother's reports, and his ability to integrate both correct and scrambled letter strings all are consistent with the conclusion that the precocious development of phonologically based word identification skill is associated with superior working memory (Jackson & Myers, 1982; Jackson et al., 1988; Naslund & Schneider, 1990). However, this association has not appeared in all studies and may be limited to early ages or lower ability levels within the precocious population (Jackson, et al., 1990).

Max's WPPSI-R Information performance and a professional evaluation of the words used in two language samples were also consistent with group data suggesting only a modest relationship between reading precocity and semantic development (Jackson, in press). On the other hand, Max's productive vocabulary score was the highest he earned on the CDI, higher than the percentile ranks he earned for the length and syntactic complexity of his

utterances. The validity and reliability of the CDI are still being established, and it is possible that parent reports do not differentiate well among types and degrees of linguistic precocity in children at the upper age limit of the scale. The hypothesis that precocious readers' oral language is distinguished primarily by length and complexity of productions merits testing, particularly since syntactic production has been found to be delayed in pre-dyslexic children (Scarborough, 1990).

When literacy develops very early, expected relations among skills, such as connections between reading and writing; between reading and oral language; and between phonemic awareness and reading, are not always present or detectable. The study findings suggest the importance of looking for target skills, not just supposed prerequisites, in evaluating precocious readers.

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Table 1

Max's PIAT-R Reading Recognition and Reading Comprehension Performance at Two Ages, with Reading Recognition Scored Two Ways

Measure	Age at Test in Years and Months	
	2;7	Age 3;2
Reading Recognition (Standard Scoring)		
Age Equivalent	less than 5;0	less than 5;0
Grade Equivalent	K.0	K.0
Reading Recognition Scored Assuming All Pre-reading Items Correct		
Age Equivalent	5;11	7;0
Grade Equivalent	K.9	1.8
Reading Comprehension (Standard Scoring)		
Age Equivalent	n/a	7;3
Grade Equivalent	n/a	1.8

Figure Caption

Figure 1. Time line summarizing highlights of Max's reading development. Events between 2;7 and 3;2 were observed by the first author. Those before and after this age period were reported by Max's mother.

AGE	MILESTONES AND OBSERVATIONS
1;6	Began watching "Sesame Street"
1;7	
1;8	Accurately identified capital letters on five blocks
1;9	Read "pizza"
1;10	
1;11	
2;0	
2;1	Mother began composition book
2;2	
2;3	
2;4	
2;5	Mother contacted investigators
2;6	
2;7	Sounded out new words; PIAT-R and MacArthur CDI; MLU
2;8	Second MLU sample
2;9	Consistent attempts to sound out words
2;10	Test of Early Reading Ability and Concepts about Print
2;11	
3;0	Test for Auditory Comprehension of Language-Revised
3;1	Read "cholesterol;" created "silly words"
3;2	WPPSI-R Information, PIAT-R retest
3;3	
3;4	
3;5	
3;6	
3;7	
3;8	
3;9	
3;10	Read silently and aloud, including newspapers; difficulty copying letters; drawings representational; creative oral language play